REMARKS

Claims 1-19 are pending in the present application. By this response, claims 1, 5, 7, 9-11, 15, 17 and 19 are amended. Claims 1, 11 and 19 are amended to correct for antecedent basis and to more clearly recite the subject matter which Applicants regard as the invention. Claims 5, 7, 9, 10, 15 and 17 are amended to correct for antecedent basis in view of the amendments to claims 1 and 11. Claims 7 and 17 are further amended to clarify prior abbreviations. Claim 15 is further amended to correct its dependency. Reconsideration of the claims in view of the above amendments and the following remarks is respectfully requested.

I. Examiner Interview

Applicants thank Examiner Nguyen for the courtesies extended to Applicants' representative during the September 8, 2004 telephone interview. During the interview, the differences of the applied references to that of the presently claimed invention were discussed. Examiner Nguyen indicated that the current claims read over the applied references. Therefore, it is Applicants understanding that, pending an update search by Examiner Nguyen the present claims are now in condition for allowance. The substance of the interview is summarized in the remarks of Section III, which follows.

II. 35 U.S.C. § 112, Second Paragraph, Claims 1-19

The Office Action rejects claims 1-19 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter, which applicants regard as the invention. This rejection is respectfully traversed. Claims 1, 11 and 19 are amended for clarity by providing proper antecedent basis and to more clearly recite the subject matter which Applicants regard as the invention. Therefore, the rejection of claims 1-19 under 35 U.S.C. § 112, second paragraph is overcome.

III. 35 U.S.C. § 103, Alleged Obviousness, Claims 1-19

The Office Action rejects claims 1-19 under 35 U.S.C. § 103(a) as being unpatentable over Pettey et al. (U.S. Patent No. 6,594,712 B1) in view of Acharya (U.S. Patent No. 6,459,698 B1). This rejection is respectfully traversed.

As to claims 1, 11 and 19, the Office Action states:

> As to claim 1, Pettey teaches the invention substantially as claimed including a method for partitioning a computer network end node (col. 6, lines 14-29), the method comprising:
>
> - virtualizing a plurality of network devices on a single multi-function chip by means of a combination of hardware and software (col.6, lines 20-47 and fig.1); and
> - virtualizing at least one router on the multi-function chip by means of a combination of hardware and software (col.6, lines 22-27 and fig.1), wherein the virtual router performs control-flow processing for the virtual network devices (col. 6, lines 23-38 and figs. 7a-7b);
>
> wherein the virtual network devices and virtual router form a virtual subnet (col.6, lines 31-38).
>
> Pettey does not explicitly teaches the virtual router functions of destination lookup and packet forwarding are incurred only on control-flow processing.
>
> Acharya teaches the virtual router functions of destination lookup and packet forwarding are incurred only on control-flow processing (abstract and col.2, lines 22-35).
>
> It would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Acharya and Pettey because Acharya's teaching would have provided the capability of efficiently sending and receiving data packets on an Infiniband network according to the determined service level.

Office Action dated June 15, 2004, pages 3-4.

Claim 1, which is representative of the other rejected independent claims 11 and 19 with regard to similarly recited subject matter, reads as follows"

> 1. A method for partitioning a computer network end node, the method comprising:
>
> virtualizing a plurality of network devices on a single multi-function chip by means of a combination of hardware and software to form virtual network devices; and
>
> virtualizing at least one router on the single multi-function chip by means of a combination of hardware and software to form a virtual router, wherein the virtual router performs control-flow processing for the virtual network devices, and wherein the virtual router functions of destination

lookup and packet forwarding are incurred only on control-flow processing;

wherein the virtual network devices and virtual router form a virtual subnet.

Pettey and Acharya, taken alone or in combination, fail to teach or suggest virtualizing a plurality of network devices on a single multi-function chip by means of a combination of hardware and software to form virtual network devices, virtualizing at least one router on the single multi-function chip by means of a combination of hardware and software to form a virtual router, wherein the virtual router performs control-flow processing for the virtual network devices and wherein the virtual router functions of destination lookup and packet forwarding are incurred only on control-flow processing, and wherein the virtual network devices and virtual router form a virtual subnet.

Pettey is directed to an Infiniband channel adapter for performing direct data transfers between a PCI bus and an Infiniband link without double-buffering the data in system memory. In the Pettey system, a local processor programs the channel adapter to decode addresses in a range of the PCI bus address space dedicated to direct transfers. When an I/O controller attached to the PCI bus transfers data from an I/O device to an address in the dedicated range, the channel adapter receives the data into an internal buffer and creates an Infiniband RDMA Write packet for transmission to virtual address within a remote Infiniband node. When the channel adapter receives an Infiniband RDMA Read Response packet, the channel adapter provides the packet payload data to the I/O controller at a PCI address in the dedicated range.

Thus, in the system of Pettey, the Infiniband channel adapter couples to an I/O controller via a local bus interface. The local bus interface receives data from the I/O controller if a local bus address of the data is within a predetermined address range of the local bus address space. The Office Action claims that Pettey teaches virtualizing a plurality of network devices on a single multi-function chip by means of a combination of hardware and software to form virtual network devices, at column 6, lines 20-47 and Figure 1, which read and are shown as follows:

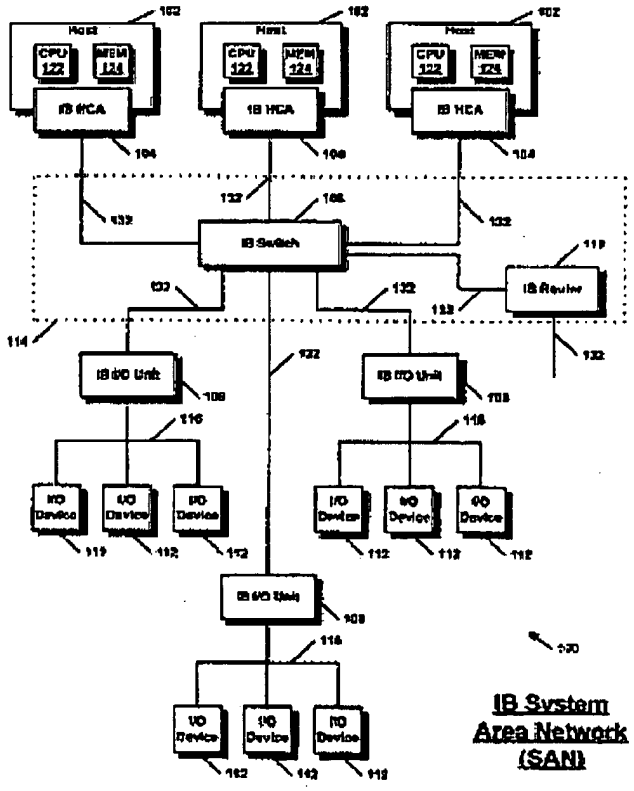
The hosts 102 are IB processor end nodes, such as server computers, that comprise at least a CPU 122 and memory 124 complex. Each of the hosts 102 includes one or more IB Host Channel Adapters (HCA) 104 for interfacing the hosts 102 to an IB fabric 114. The IB fabric

114 is comprised of one or more IB Switches 106 and IB Routers 118 connected by a plurality of IB serial links 132. For example, an HCA 104 may be coupled to a host 102 via a PCI bus or the HCA 104 may be coupled directly to the memory and/or processor bus of the host 102.

The SAN 100 also includes a plurality of IB I/O units 108 coupled to the IB fabric 114. The IB hosts 102 and IB I/O units 108 are referred to collectively as IB end nodes. The IB end nodes are coupled by the IB switch 106 that connects the various IB links 132 in the IB fabric 114. The collection of end nodes shown comprises an IB subnet. The IB subnet may be coupled to other IB subnets (not shown) by the IB router 118 coupled to the IB switch 106.

Coupled to the I/O units 108 are a plurality of I/O devices 112, such as disk drives, network interface controllers, tape drives, CD-ROM drives, graphics devices, etc. The I/O units 108 may comprise various types of controllers, such as a RAID (Redundant Array of Inexpensive Disks) controller. The I/O devices 112 may be coupled to the I/O units 108 by any of various interfaces, including SCSI (Small Computer System Interface), Fibre-Channel, Ethernet, IEEE 1394, etc.

(Column 6, lines 20-47)



(Figure 1)

In this section and Figure, Pettey is describing how the hosts 102 include one or more IB Host Channel Adapters 104 for interfacing the hosts 102 to an IB fabric 114. The IB fabric 114 is comprised of one or more IB Switches 106 and IB Routers 118 connected by a plurality of IB serial links 132. Thus the numerous devices are interfaced to each other through the use of an Infiniband fabric 114. An Infiniband fabric is part of the InfiniBand Architecture (IBA), which is designed around the point-to-point switched I/O fabric whereby each node device is interconnected by cascade switch devices. This architecture specifies an interconnection technology between processor nodes, and I/O nodes in order to form a System Area Network (SAN). IBA SAN consists of the processor nodes (HCAs) and I/O units (TCA) connected through the IBA fabric made up of the cascaded switches and the routers. Thus, the devices, in the system of Pettey, are separate physical devices that are separately interconnected through the Infiniband fabric and are not a plurality of network devices virtualized on a single multi-function chip by means of a combination of hardware and software to form virtual network devices.

Furthermore, Pettey does not teach or suggest virtualizing at least one router on the single multi-function chip by means of a combination of hardware and software to form a virtual router. The Office Action alleges that this feature is taught by Pettey at Figure 1 and column 6, lines 22-27, shown above. As discussed above, Pettey teaches an IB fabric, that is comprised of Infiniband switches and Infiniband routers connected by a plurality of Infiniband serial links. The switches and routers are physical devices that are interconnected through the Infiniband fabric. Neither the switches nor the routers are virtualized. Thus, Pettey does not teach virtualizing at least one router on the single multi-function chip by means of a combination of hardware and software to form a virtual router.

Additionally, Pettey does not teach or suggest the virtual network devices and virtual router form a virtual subnet. The Office Action alleges that this feature is taught by Pettey at column 6, lines 31-38, shown above. In the cited section, Pettey is merely describing that the physical devices, IB hosts and IB I/O units, connected through the Infiniband fabric are referred to collectively as IB end nodes. The coupling of the IB end nodes by the IB switch comprises an IB subnet. While Pettey may teach a subnet comprised of hosts and switches, the subnet is a physical subnet and not a virtual subnet.

Furthermore, the switches and hosts that comprise the subnet of Pettey are physical devices and not virtual network devices and a virtual router.

Furthermore, Pettey does not teach or suggest the virtual router functions of destination lookup and packet forwarding are incurred only on control-flow processing. The Office Action admits that Pettey does not teach this feature on page 4 but alleges that Acharya teaches this feature, Acharya does not provide for the deficiencies of Pettey and, thus, any alleged combination of Acharya and Pettey would not be sufficient to reject claims 1, 11 and 19. That is Acharya does not teach virtualizing a plurality of network devices on a single multi-function chip by means of a combination of hardware and software to form virtual network devices, virtualizing at least one router on the single multi-function chip by means of a combination of hardware and software to form a virtual router, wherein the virtual router performs control-flow processing for the virtual network devices and wherein the virtual router functions of destination lookup and packet forwarding are incurred only on control-flow processing, and wherein the virtual network devices and virtual router form a virtual subnet. The Office Action alleges that Acharya teaches the virtual router functions of destination lookup and packet forwarding are incurred only on control-flow processing, in the abstract and at column 2, lines 22-35, which read as follows:

> A router is configured for sending and receiving data packets on an InfiniBand™ network and acts as a bridge between an IP network and the InfiniBand™ network. The router is configured to receive an Internet Protocol (IP) data packet having an IP header including a type of service (TOS) field having a differentiated services code point indicative of layer 3 priority data of the IP packet. The router includes a mapping table having multiple entries, each entry specifying a differentiated services code point and a corresponding service level. The controller is configured for parsing the TOS field and determining the service level for the differentiated services level. The controller outputs the IP packet on the InfiniBand™ network within an InfiniBand™ packet according to the determined services level.

(Abstract)

> These and other needs are attained by the present invention, where a router is configured for sending and receiving data packets on an InfiniBand™ network. The router is configured to receive an Internet Protocol (IP) data packet having an IP header including a type of service (TOS) field having a differentiated services code point indicative of layer

> 3 priority data of the IP packet. The router includes a mapping table having multiple entries, each entry specifying a differentiated services code point and a corresponding service level. The controller is configured for parsing the TOS field and determining the service level for the differentiated services level. The controller outputs the IP packet on the InfiniBand™ network within an InfiniBand™ packet according to the determined services level.

(Column 2, lines 22-35)

In these sections, Acharya is describing a physical router connected to an Infiniband network. The physical router uses a mapping table to receive IP data packets. Acharya teaches a physical router, which is not a virtual router on single multi-function chip, along with a plurality of virtualized network devices, which is virtualized by means of a combination of hardware and software. Additionally, Acharya does not teach or suggest control-flow processing. Nowhere in the Acharya reference, is control-flow processing even mentioned. Thus, Acharya fails to teach or suggest a virtual router that has functions of destination lookup and packet forwarding which are incurred only on control-flow processing.

Furthermore, there is not so much as a suggestion in either reference to modify the references to include such features. That is, there is no teaching or suggestion in Pettey or Acharya that a problem exists for which virtualizing a plurality of network devices on a single multi-function chip by means of a combination of hardware and software to form virtual network devices, virtualizing at least one router on the single multi-function chip by means of a combination of hardware and software to form a virtual router, wherein the virtual router performs control-flow processing for the virtual network devices and wherein the virtual router functions of destination lookup and packet forwarding are incurred only on control-flow processing, and wherein the virtual network devices and virtual router form a virtual subnet, is a solution. To the contrary, Pettey only teaches the connection of physical devices through an Infiniband fabric. Acharya only teaches a physical router that uses a mapping table to receive IP packets. Neither reference even recognizes a need to virtualizing a plurality of network devices and router on a single multi-function chip by means of a combination of hardware and software to form virtual network devices and a virtual router, where the virtual router performs control-flow processing for the virtual network devices and where the virtual router

functions of destination lookup and packet forwarding are incurred only on control-flow processing, and wherein the virtual network devices and virtual router form a virtual subnet, as recited in claim 1.

Moreover, neither reference teaches or suggests the desirability of incorporating the subject matter of the other reference. That is, there is no motivation offered in either reference for the alleged combination. The Office Action alleges that the motivation for the combination is "Acharya's teachings would have provided capability for efficient sending and receiving data packets on an Infiniband network according to the determined service level." Neither reference teaches virtual network devices, virtual routers, a single multifunction chip or control-flow processing. Thus, the only motivation to even attempt the alleged combination would be based on a prior knowledge of Applicants' claimed invention thereby constituting impermissible hindsight reconstruction using Applicants' own disclosure as a guide.

One of ordinary skill in the art, being presented only with Pettey and Acharya, and without having a prior knowledge of Applicants' claimed invention, would not have found it obvious to combine and modify Pettey and Acharya to arrive at Applicants' claimed invention. To the contrary, even if one were somehow motivated to combine Pettey and Acharya, and it were somehow possible to combine the two systems, the result would not be the invention, as recited in claim 1. The result would be a network of physical devices and routers connected through an Infiniband fabric that receives IP packets using a mapping table. The resulting system still would not virtualize a plurality of network devices on a single multi-function chip by means of a combination of hardware and software to form virtual network devices, virtualize at least one router on the single multi-function chip by means of a combination of hardware and software to form a virtual router, wherein the virtual router performs control-flow processing for the virtual network devices and wherein the virtual router functions of destination lookup and packet forwarding are incurred only on control-flow processing, and wherein the virtual network devices and virtual router form a virtual subnet.

Thus, Pettey and Acharya, taken alone or in combination, fail to teach or suggest all of the features in independent claims 1, 11 and 19. At least by virtue of their dependency on claims 1, 11 and 19, the specific features of claims 2-10 and 12-18 are not

taught or suggested by Pettey and Acharya, either alone or in combination. Accordingly, Applicants respectively request withdrawal of the rejection of claims 1-19 under 35 U.S.C. § 103(a).

Moreover, in addition to their dependency from independent claims 1 and 11, the specific features recited in dependent claims 2-10 and 12-18 are not taught or suggest by Pettey and Acharya, either alone or in combination. Claims 2-4 and 12-14 pertain to virtual network devices. As shown above, neither Pettey nor Acharya teach or suggest virtual devices of any sort but rather physical devices. Claims 5-8 and 15-18 pertain to virtual subnets. As shown above, Pettey teaches a physical subnet comprised of physical IB hosts and physical IB I/O units, neither of which are virtual network devices and neither of which comprise a virtual subnet. Claims 9 and 10 pertain to a single multi-function chip. As shown above, neither Pettey nor Acharya teach or suggest a single multi-function chip that contains virtualized network devices and at least one virtualized router on the single multi-function chip by means of a combination of hardware and software.

IV. Objection to Claims

The Office Action states that claims 7 and 14 are objected to because abbreviations used in these claims should be defined. Applicants respectfully submit that claim 17 contains an abbreviation and not claim 14. Thus, claims 7 and 17 have been amended to clarify the subject matter Applicants regard as the invention to overcome this objection.

V. Conclusion

It is respectfully urged that the subject application is patentable over the prior art of record and is now in condition for allowance. The Examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the Examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

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Respectfully submitted,

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